CONSERVATION STATUS OF THE THREE KINGS ISLANDS ENDEMIC FLORA IN 1982

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Abstract. Despite the classification of many of the Three Kings Islands' endemic plants as threatened species, they were last surveyed by botanists in 1963. The most recently published detailed information on their distribution and population size appeared in 1951. The present survey was carried out to provide a current report on the conservation status of the endemic flora of the islands, on which vegetation management decisions could be based. In 1982, all the endemic taxa were found to be present in equal or greater numbers of individuals than have been found in the past. Management strategies are briefly discussed.

An Offshore Islands Research Group expedition to the Three Kings Islands from 12 to 18 December 1982 afforded the first opportunity for a review of the conservation status of the locally endemic plant flora in over 30 years.

A sizeable population of goats on the largest island, Great Island, had seriously depleted the vegetation and effectively halted regeneration of palatable species by the time they were exterminated in 1946. By this time, two of the endemic species had been reduced to single individuals, and several others to extremely small populations surviving in degraded and marginal habitats.

Following removal of the goats, regeneration of the plant cover proceeded rapidly. This regeneration has been discussed by Baylis (1948, 1951b, 1958) and Turbott (1963), and specifically studied by Holdsworth (1951) and Holdsworth & Baylis (1967) through a series of three permanent vegetation quadrats set up immediately following the extermination of the goats (Turbott 1948).

However, the vascular flora of the Three Kings Islands was last studied by botanists in 1963 as a corollary to work on the vegetation quadrats (Holdsworth & Baylis 1967) and on a short visit made by Mr Ross Michie and others (Michie 1963). Despite these reports the most recent account of the conservation status of the endemic plants appeared over 30 years ago (Bayliss 1951b). Although dramatic regrowth of the vegetation was reported at that time, some of the endemic species had failed to reproduce in substantial numbers. Consequently, fears had been expressed for the survival of some species in the wild during the intervening period to the present.

Thus, the 1982 expedition offered Professor G.T.S. Baylis and myself an opportunity to re-survey the distribution, and population size and structure of the endemic plants, and recommend a suitable management policy for the islands' vegetation. Five days were spent on Great Island and brief landings were made on West and South West Islands.

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ENDEMIC FLORA

In the past, thirteen taxa of vascular plants have been considered to be endemic to the Three Kings Group (Baylis 1958, Allan 1961, Moore & Edgar 1970), and a fourteenth was known only from one small island elsewhere (Baylis 1963). One of these plants *(Cordyline kaspar)* and possibly a second *(Alectryon grandis)* have subsequently been recognised on the Poor Knights Islands (Wright in prep.). A third, *Coprosma macrocarpa*, was interpreted by Allan (1961) as having a distribution beyond the Three Kings, though there is no doubt that Cheeseman (1888) erected the species solely for the large-fruited Three Kings plants. *Solanum aviculare* var. *latifolium* was based on Three Kings material, although it has also been recorded from Fanal Island in theMokohinau Group (Baylis 1963). Regardless of actual or possible wider distributions, all these taxa will be considered together with the undoubted endemic plants in this paper.

Alectryon grandis Cheeseman

In 1945 (Baylis 1948), two trees of the Three Kings' titoki were mapped, one at each of localities 1 and 2 on Fig. 1. Baylis (1951b) found no seedlings near either of these trees but added a further two trees and plentiful seedlings over *ca.* "50 yards" [45.7 m] along the bottom of a small gully on the northern side of the northern headland of Tasman Bay (Fig. 1, locality 3), which were overlooked in the preparation of the 1945 map. Michie (1963) found the tree at locality 2, erroneously recording that this was "the only place where a few trees had been previously discovered". Despite searching, we failed to find either of the trees at localities 1 or 2 in 1982. However, the population at locality 3 had expanded considerably by 1982. It was established on rocky ground in the head of a slight but steep gully above the coastal cliffs. Seventeen mature trees (several up to 12 cm diameter at breast height (d.b.h.) and 6-7 m tall), 13 saplings and 22 seedlings were counted over an area approximately 80 x 15 m. The titoki had spread into the neighbouring small gully to the south. Here, a further seven mature trees and four saplings were found. Several of the mature trees were flowering heavily, and abundant remains of seeds were found beneath them.

Brachyglottis arborescens W.R.B. Oliver

Baylis (1948, 1951b) recorded the presence of two moribund groves of the Three Kings' rangiora surrounded by "thickets of seedlings up to 6 feet" [1.8 m] high, at localities 4 and 5 (Fig. 1). He found occasional seedlings further from these sources, noting however that the species had not yet entered Tasman Valley. His 1948 list recorded the plant as rare, with 35 individuals in existence.

By 1963, this species was present in Quadrats I and II (Fig. 1, locality 6), although it contributed a relatively small basal area to the plots (Holdsworth & Baylis 1967: 183). Michie (1963) noted that the rangiora was "fairly well distributed over the island". By 1982 it was locally abundant in many areas. It apparently favours the rich soils associated with sea-bird burrowing and appears to attain maturity very quickly in these situations. Many older trees were showing signs of senescence; canopy gaps resulting from the few dead trees observed were being filled by numerous seedlings and saplings of the same species. As these dead trees were found in areas which have been colonised by the species

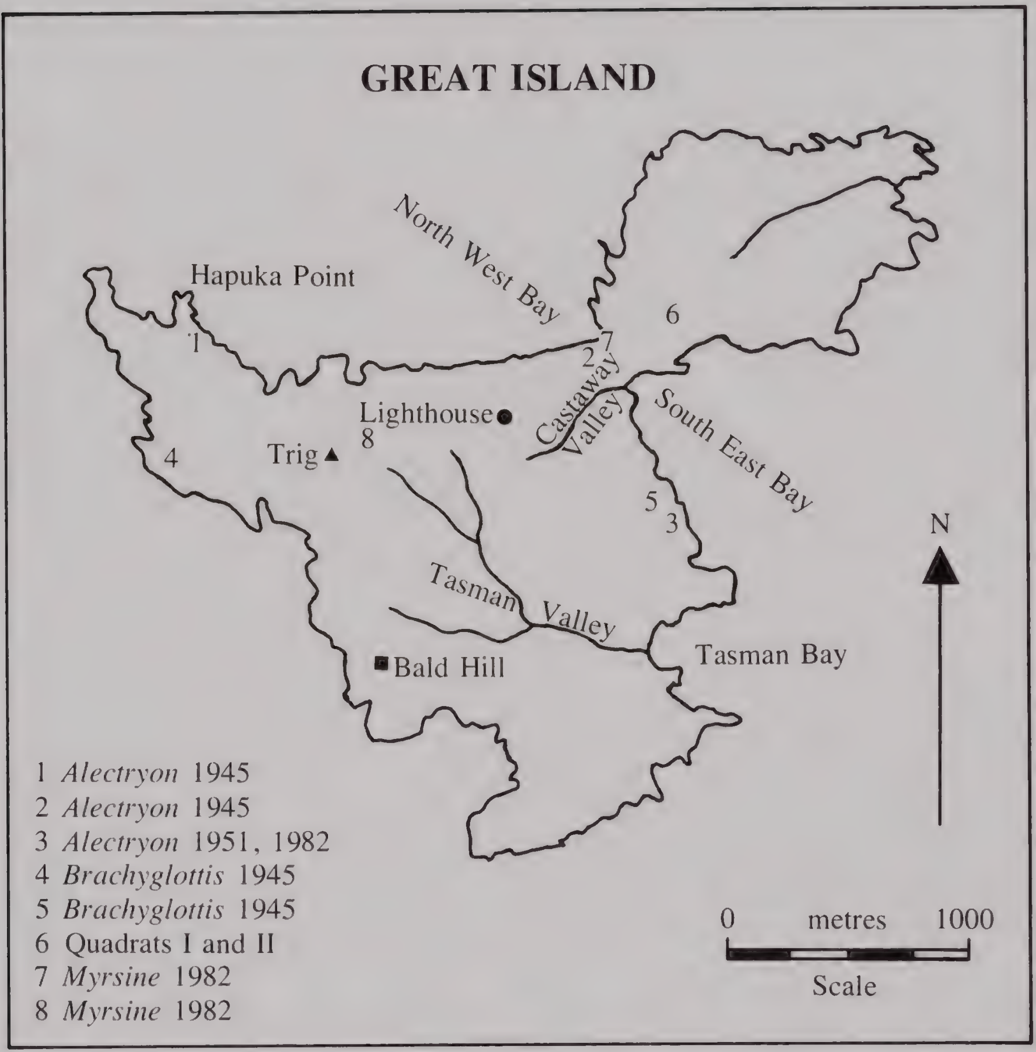

Fig. 1. Map of Great Island, Three Kings Islands, showing localities mentioned in the text.

since the removal of goats, the rangiora is apparently to some extent a short-lived, opportunistic element of the Three Kings' flora. One of Baylis's original groves was relocated (Fig. 1, locality 5). Here, slower growing trees in the rocky soils at this site had developed trunks to 30 cm in diameter, with their characteristic deeply furrowed bark.

Carex elingamita Hamlin

This species was described byHamlin in 1958. Previously it had been considered a part of *C. forsteri* Wahl. (Baylis 1948, Oliver 1948), and had therefore attracted no special mention. Baylis (1958) described the species on South West Island, where it provided a ground cover "dotted at intervals" along the forest floor, and Hamlin (1958:

393) listed specimens from each of the four main islands in the group. Michie (1963) noted the existence of an endemic species of *Carex*, but made no reference to having seen it on Great Island.

Carex elingamita was found to be a common ground cover plant beneath forest canopy on both West and South West Islands in 1982. However, on Great Island it was infrequently seen. Here, *Carex testacea* replaces *C. elingamita* as the dominant ground cover sedge. The thinner leaved, generally tougher *C. testacea* may have withstood browsing by goats more successfully than the wider leaved *C. elingamita* which is now more or less confined to the regenerating stands of broadleaved forest (*Meryta sinclairii* (Hook. f.) Seem., *Brachyglottis arborescens*, *Streblus smithii* (Cheesem.) Corner and *Pisonia brunoniana* Endl.) — that is, a similar habitat to that in which it is found on West and South West Islands. *Carex testacea* forms dense swards beneath the relatively open kanuka (*Leptospermum ericoides* A. Rich.) canopy in the head of Tasman Valley, where it has every appearance of a browsing-induced dominant. When (and if) this community is replaced by the denser canopied broadleaved species, *C. testacea* may be shaded out and replaced by *C. elingamita*.

Coprosma macrocarpa Cheeseman

Following the extermination of goats in 1946, protracted searching led to the discovery of four individuals of this species (Baylis 1948), despite the fact that Cheeseman (1888) had recorded the plant as common. By 1951, young plants were common in the bottom of Tasman Valley, and a few seedlings had reached Castaway Valley (Baylis 1951b). Michie (1963) recorded the species as "well distributed", although in the same year, Holdsworth & Baylis (1967) did not record it in either of Quadrats I or II. By 1982 it was truly well distributed over the island, being encountered in all areas explored. Despite the inclusion of mainland forms under this name by later workers (e.g. Allan 1961), it is clear that Cheeseman (1888), when describing the species, saw fruit size as the major distinction between the Three Kings plants and related forms. He gave the average length of fruit "as about three-quarters of an inch" [19 mm], and observed some specimens "over one inch" [26 mm]. Although no fruit of comparable size was seen in 1982, all berries were at least twice the size of those of any of the northern mainland taxa of this genus.

Cordyline kaspar W.R.B. Oliver

This species (listed as *C. australis* prior to its description by Oliver 1956) has always been recorded as common on Great Island. Baylis (1951b) stated that "cabbage trees were well dispersed over the island in 1945 and were flowering abundantly". In 1982, the Three Kings cabbage tree was found to be a visually dominant part of almost all plant communities on Great Island.

Davallia tasmanii H.C. Field

This fern was discovered by Cheeseman on Great Island in 1887 and initially described without name (Cheeseman 1888). Following his second visit to the islands in 1889, Cheeseman prepared a further paper which included a description and name for the *Davallia* which was read before the Auckland Institute on 3 November 1890. However, it was not published until 1891 (Cheeseman 1891). Meanwhile, H.C. Field had published the name in his *Ferns of New Zealand* (Field 1890), thereby technically becoming the author of the name *Davallia tasmanii*.

This is another of the endemic species which seems to have withstood the depredations of goats fairly well. It can grow in rock crevices and on the lower parts of tree trunks, and now often forms extensive colonies on the open floor of kanuka forestm

Elingamita johnsonii G.T.S. Baylis

This species, endemic to West Island in the Three Kings Group, was discovered by Major Johnson in January 1950. He returned to the island with Professor Baylis in the following year, and Baylis subsequently (1951a) formally described the new species. Baylis's observations were made in dense fog, in which the full extent of the population could not be seen. He recorded "perhaps a dozen trees" on West Island. No landings had been reported subsequently until our party went ashore for several hours on 17 December 1982. We were fortunate to experience clear, sunny weather in which the *Elingamita* could be photographed *in situ* for the first time, and a clear description of the plant's habit and distribution made.

The first plant was found in low scrub composed mainly of N.Z. flax (*Phormium tenax* J.R. et G. Forst.) with small amounts of houpara (*Pseudopanax lessonii* (D.C.) C. Koch), kawakawa (*Macropiper excelsum* (Forst.f.) Miq. var. *majus* (Cheesem.) Allan) and *Hymenanthera novae-zelandiae* (A. Cunn.) Hemsl. just above the site of the wreck of the *S.S. Elingamite*. This plant bore panicles of open flowers, bunches of unripe green fruit and the remnants of bunches of ripe red fruit, indicating the probability of a two year cycle from flowering to fruit maturity.

A scattering of shrubby small trees and saplings was found at the base of the irregular row of rocky bluffs along the southern face of the island. The major population containing the oldest trees was found in a small area of pohutukawa (*Metrosideros excelsa* Sol. ex Gaertn.) forest near the summit of the island. The pohutukawas provided a semi-continuous canopy some 10-12 m high, beneath which *Elingamita* formed an understorey 2-4 m high. A dozen trees were sighted from one point in this area of forest, each bearing hanging bunches of ripe scarlet fruit. Numerous seedlings were found in the rich, light humus between the rocks — there were nine growing in one area three centimetres square. The seedlings exhibit the same conspicuously thickened, fleshy looking stems as the adults.

Despite their obvious attractiveness, there was no evidence of birds having eaten the ripe fruit. Although seedlings have been dispersed over several hundred metres from this main colony, they are most common beneath fruiting trees, and have not reached other apparently suitable habitats in developing forest on the main ridge of the island. It is presumably only a matter of time before the species is naturally introduced or reintroduced to other islands in the Three Kings Group.

Hebe insularis (Cheeseman) Cockayne et Allan

Northern species of *Hebe* are usually highly palatable to goats and the Three Kings' endemic is apparently no exception. By 1946 (Baylis 1948) it was restricted to sites inaccessible to goats, mainly on the sea cliffs. Baylis (1951) recorded its appearance on Bald Hill — the first woody species to occupy this most barren part of the Three Kings' landscape. In 1982 it was still predominantly a plant of cliffs, and had increased its range on Bald Hill where compact shrubs were the locally dominant vegetation, dotted over an area of still partially bare ground several hundreds of metres square. Its present distribution reflects the habitat requirements of a low growing, light demanding shrub rather than any failure to spread following the extermination of goats. The species is now frequently met in coastal situations that would have been accessible to goats.

Myrsine oliveri Allan

In 1945, Baylis (1948) saw seven individuals of this species, some located near the present Trig station on the highest point of Great Island (Fig. 1) and some with one of the original *Alectryon* trees, (Fig 1, locality 1). Oliver (1948: 231) gave a slightly different distribution for the seven plants. In 1951, Baylis (1951b: 106) noted that no seedlings were seen beside any of the existing trees of this species. Fruiting had only been observed on two trees, both at Hapuka Point (Fig 1, locality 1), one of which died between 1945 and 1951. Baylis (1951b) also recorded a few seedlings which seemed to be of this species about the campsite in Castaway Valley. That he was unsure of the identity of the seedlings is no doubt due to the close similarity between young vegetative material of this species and of *Hymenanthera novae-zelandiae*.

By 1982 the population of *Myrsine oliveri* appeared to be bigger than in 1951. The present stronghold for the species is the area supporting the *Alectryon* colony (Fig. 1, locality 3). Here, two distinct forms occurred: two young saplings in an exposed situation on a grassy ridge exhibiting thickened yellowish leaves, and six mature trees beneath adjacent kanuka canopy with glossy, dark green leaves. These last bore a sparse crop of fruit, the largest tree being 4 m high, having a spread of 2.5-3 m and a split trunk of 8 + 4 cm d.b.h. Both exposed and shaded plants were healthy and growing vigorously, but no seedlings were located. A further six plants to 2 m tall were found amongst the regenerating coastal forest in the lighthouse clearing (Fig. 1), and single young shrubs were found on the ridge between North West and South East Bays (Fig. 1, locality 7), and at the clifftops near the Trig (Fig. 1, locality 8). Again, no seedlings were seen at any of these localities.

Pennantia baylisiana (W.R.B. Oliver) G.T.S. Baylis

The sole wild tree of this species has not produced any seedlings. Of the two cuttings planted adjacent to the parent tree by Professor Baylis in 1971, one survives and has doubled in size. The tree has grown considerably since its discovery, and was looking very vigorous and healthy. The foliage appeared to be far less insect damaged than past photographs and herbarium specimens indicate. The surrounding habitat, shown by Oliver

(1948: pl. 32) as bare rock scree, has regenerated almost beyond recognition with a thick cover of ferns and herbs, and the base of the *Pennantia* is now obscured by a dense growth of its own shoots.

The tree was profusely covered in bunches of small ovaries, approximately 1 x 1.5 mm, and probably unfertilised. The status of occasional larger "fruit" scattered through these bunches is uncertain, and should be investigated with a view to encouraging production of viable seed.

Pittosporum fairchildii Cheeseman

From the four plants known at the time of the extermination of goats (Baylis 1948), a healthy and widespread population has developed. By 1951 seedlings were spreading from the parent trees, and in 1963 Michie recorded the species as fairly common in the western part of the island.

In 1982 plants were occasionally encountered over most of the island. The greatest concentrations of the species occur in rocky areas near Quadrats I and II, and beneath tall, sparse kanuka forest in the head of Tasman Valley. In Tasman Valley, particularly in the headwaters of the true right branch of the stream, the plant is abundant. It ranges from seedlings to 3 m high trees of 5-6 cm d.b.h., both beneath and occasionally thrusting through the kanuka canopy. Many of the trees bore a heavy crop of almost ripe yellow fruit in November 1982.

Solanum aviculare Forst. f. var. *latifolium* G.T.S. Baylis

This taxon was noted by Cheeseman (1889) as *S. aviculare*, and was apparently extinct on Great Island at the time of the goat extermination. The first find this century was made in 1947 (Baylis 1948, appendix). Baylis (1951b) characterised the plant as an "aggressive temporary occupant" of disturbed sites, and this holds true today. In 1982 it was found on both Great and South West Islands in soils disturbed by sea-bird burrows (amongst the coastal margins of vascular plant vegetation and on inland ridges), and in areas opened up by the death of mature trees. One 60 cm high juvenile on South West Island exhibited leaves over 50 cm long with four or five pairs of lateral lobes. Although the plant was never seen in great numbers, it fruits freely and seeds germinate readily in suitable habitats. It is a long term "weed" species in the Three Kings' flora.

Streblus smithii (Cheeseman) Corner

The Three Kings' milk tree survived the onslaught of goats better than any of the other dicotyledonous endemics, being classed as "occasional" by Baylis (1948). Young plants were common in 1951 (Baylis 1951b), having spread from old trees growing in the valley bottoms. By 1982 the species was a widespread understorey constituent of forest in damper areas. The Three Kings' milk tree does not show the arboreal habit of what is commonly called the large leaved milk tree (*Streblus heterophyllus* (Blume) Corner var. *elliptica* (Kirk) Corner) found on other northern offshore islands; rather it is diffuse, even semi-lianoid, and mature trees resemble untended domestic figs (*Ficus carica* L.) in habit.

Tecomanthe speciosa W.R.B. Oliver

This last of the endemic species was also described from a single plant growing in the TasmanValley (Oliver 1948). At the time of its discovery, all other suitable habitats were easily accessible and searching failed to locate any further plants. Baylis (1951b) reported no evidence of seed production, though the vine had layered itself at one point well removed from the old base. The plant was relocated by Michie (1963) who reported "All accounts I have read concerning this climber have stated that only one vine existed. This however, is not correct; there is a group of four separate flourishing vines, which may have and probably did come from the largest vine originally".

In 1982 the main vine, emanating from a rootstock 5 cm in diameter, was climbing a young pigeonwood (*Hedycarya arborea* J.R. et G.Forst.). Layering has produced rooted vines at a further six points up to 10 m from the original. Despite the increased number of vines, the foliage appeared to be less dense than the early descriptions and illustrations indicate. No flowers or fruit were seen, and no seedlings were found. Although the Three Kings' plant has been observed flowering (Oliver 1948: pl. 33), seed pods have never been seen. As with the *Pennantia*, further research into the breeding system may lead to seed production by the plants growing on Great Island.

DISCUSSION

All the Three Kings Islands' endemic plant taxa were found to be present in numbers equal to or greater than have been seen in the past. Most have shown strong recoveries since the removal of goats in 1946 and now exist in naturally sustainable, sexually reproducing populations. The exceptions are the two species represented by single individuals — *Pennantia baylisiana* (disregarding the planted cutting) and *Tecomanthe speciosa*. Despite the ability of the latter to reproduce vegetatively to a limited degree, their long term future in the wild is not at all certain. However, there is no longer any threat to their absolute survival as both are now recognised as good garden plants and are propagated commercially.

The only other species with an uncertain future is *Myrsine oliveri*. Although the known plants are widely dispersed on Great Island, the total population remains small, perhaps 30 or 40 plants (although only 16 were located in the 1982 survey). The fact that no seedlings were found is further cause for concern. This is also the only species not known in cultivation; seed and cuttings brought back to the mainland in December 1982 had not grown by August 1983.

Vegetation management

Botanically, management of reserves for the conservation of flora and fauna is usually limited to the elimination of any aggressive exotic species that appear. On Great Island this has not, and with reasonable care, should never be necessary. The process of forest regeneration is proceeding naturally from seed sources which are unusually well defined. This exceptionally favourable opportunity for studying dispersal and succession has not been neglected, and the published work (Baylis 1948, 1951b; Holdsworth 1951; Holdsworth & Baylis 1967; Turbott 1948, 1963) adds to the importance of allowing natural change to continue without interference.

Kennedy & Simpson (n.d.) formulated a research proposal in which the objective was "To carry out a survey of the status of rare and endangered plant species on the Three Kings Islands and to undertake a program of rehabilitation". The present survey effectively completed the first part of this proposal, leaving the rehabilitation programme open to debate.

Simpson (n.d.) discussed the question of the rehabilitation of endangered plant species on the Three Kings Islands in more detail and noted some of the reactions generated by the proposal. A major concern regarding the introduction of plants to Great Island lies in the very real risk of introducing pathogenic organisms, especially soil-borne fungi, to a situation where they are so far absent (P.J. Brook pers. comm.). Numerous examples of the devastation caused by, for example, *Phytophthora cinnamomi* root rot have been documented (see Newhook & Podger 1972) and the implications for the Three Kings Islands would be extremely serious.

There is no doubt that efforts must be made to ensure the survival of Three Kings' endemic plant species. However, bearing in mind Great Island's value for study of plant dispersal and succession, any steps involving manipulation of the wild habitat should be on the smallest scale practicable, and then only after substantial agreement amongst scientists from a variety of disciplines. Thus, attempts at low-key management should be made (for example to induce seed production on the existing wild *Pennantia* and *Tecomanthe* on Great Island) before higher impact measures such as replanting programmes are initiated.

As long as present conditions on the Three Kings Islands continue to exist, and all the endemic plant species are maintained in cultivation, the present management policy for the islands' vegetation is sufficient. The obvious priorities, then, are to secure *Myrsine oliveri* in cultivation, and begin research into the breeding systems of the wild populations of *Pennantia baylisiana* and *Tecomanthe speciosa*.

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